Northrop Grumman's Response to EPA's 6 March 2012 Email
Kwan, Joseph P (CO)
to:
Raymond Chavira
03/16/2012 07:12 PM
Cc:
"Brown, Elizabeth C. (Law)", Kelly Manheimer, Lewis Maldonado, "Pete MacNicholl (pmacnich@dtsc.ca.gov)"
Hide Details
From: "Kwan, Joseph P (CO)" <Joe.Kwan@ngc.com>
To: Raymond Chavira/R9/USEPA/US@EPA,
Cc: "Brown, Elizabeth C. (Law)" <Elizabeth.C.Brown@ngc.com>, Kelly Manheimer/R9/USEPA/US@EPA, Lewis Maldonado/R9/USEPA/US@EPA, "Pete MacNicholl (pmacnich@dtsc.ca.gov)" <pmacnich@dtsc.ca.gov>

3 Attachments

2012-0316-Benchmark-ltr to EPA re 6Mar12 Information Request.pdf

2012-0316-Benchmark-Source Area Investigation Memo (no attachments).pdf

2012-0315-Puente-PVOU Modeling Work Memo.pdf

Ray – Attached is Northrop Grumman's response to your 6 March 2012 email. There should be three attachments.

1. A letter from Northrop Grumman
2. A Technical Memorandum from Orion
3. A Memorandum from CDM Smith

Please note that due to the size, the "attachments" referred to in Orion's memorandum are not included in that PDF file. They have instead been uploaded to Orion's FTP site and are available for download from there. To access the FTP site, click on the following link:

http://ftp2.orionenv.com/dm/index.php?interface=download&hash=0b30896f39156f1e57454b25192c0c57

Please feel free to call if you have any questions on this submittal.

-Joe-

Joseph P. Kwan
Corporate Director, Environmental Remediation
Northrop Grumman Corporation
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Joe.Kwan@ngc.com

From: Raymond Chavira [mailto:Chavira.Raymond@epamail.epa.gov]
Sent: Tuesday, March 06, 2012 7:52 PM
To: Kwan, Joseph P (CO)
Cc: Brown, Elizabeth C. (Law); Brown, Elizabeth C. (Law); Brown, Elizabeth C. (Law); Lewis Maldonado; Kelly_Manheimer/R9/USEPA/US@EPA.epa.gov
Subject: EXT :Action Items for NGC - Due March 16, 2012

Joe,

It was good to meet with you and Elizabeth today. Per our discussion, Northrop will submit the following to EPA by Friday March 16, 2012:

A letter signed by you, accompanied by a Technical Memorandum, explaining why Northrop did not provide the Regional Board, EPA, or other relevant entity with the data collected as part of the 2002/3 Deep Source Investigation. The Tech Memo shall including CPT, groundwater, and soil bore (DB) data. EPA originally requested the Tech Memo on 1/26/2012 (see attached).

The Tech Memo shall include any work plans, all data packages, and any data analysis performed by Northrop Grumman or consultant(s) to Northrop Grumman as part of the DSI. In addition, the Tech Memo shall include a list of all work products produced since the 2002/3 DSI that did not include the data collected during the DSI. The letter and Tech Memo shall also describe any and all modeling efforts associated with Benchmark from 1987 to present, the dates the data were provided to CDM, and why Northrop and its consultants did not include DSI-related data in Benchmark or regional modeling efforts to date. In addition, please describe why permanent wells were not installed as part of the DSI.

We also agreed today that by March 8, 2012, Northrop would notify EPA as to a date by which Northrop will be able to ascertain when CDM first had access to any of the CPT data and whether CDM has used any of that data in the development of its groundwater modeling, pumping simulations, or the like for the Benchmark facility or the Intermediate Zone.

Please call me if you have any questions related to this request. For legal questions, your attorney may contact Lewis Maldonado at 415.972-3926

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16 March 2012

Mr. Raymond Chavira
Remedial Project Manager
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75 Hawthorne Street, SFD-7-3
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Re: USEPA 6 March 2012 Information Request
Former TRW Benchmark Site

Dear Mr. Chavira:

This letter responds to your 6 March 2012 email, which followed a meeting between the U.S. Environmental Protection Agency (USEPA) and Northrop Grumman Systems Corporation (Northrop Grumman) in San Francisco on that same day, requesting a letter and a Technical Memorandum "explaining why Northrop did not provide the Regional Board, USEPA, or other relevant entity with the data collected as part of the 2002/3 Deep Source Investigation." USEPA also asked that the letter and Technical Memorandum "describe any and all modeling efforts associated with Benchmark from 1987 to present, the dates the data were provided to CDM, and why Northrop and its consultants did not include DSI-related data in Benchmark or regional modeling efforts to date." To address these requests, Northrop Grumman is providing this letter, a Technical Memorandum prepared by Orion Environmental Inc. (Orion) addressing the 2002/2004 Deep Source Investigation (DSI), and a memorandum by CDM Smith addressing USEPA's modeling questions.

As we discussed during the meeting on March 6th, Northrop Grumman believes that USEPA's reaction to learning that Northrop Grumman had not provided the DSI data to the Regional Water Quality Control Board (RWQCB) in 2002 and 2004 when the data were first collected is unwarranted for two main reasons: (1) contrary to USEPA's stated view, Northrop Grumman was not "hiding" these data then or now and (2) the data mainly confirmed what Northrop Grumman, RWQCB, and USEPA already suspected – that there was some residual mass at the Benchmark site in low permeability materials below the depth of the onsite extraction wells that could not be addressed by the existing onsite groundwater pump-and-treat system.

Why Northrop Grumman did not Submit the Data in 2002/2004

As the Orion Technical Memorandum explains, the 2002 cone penetration test (CPT) data were collected to assess the lateral and vertical distribution of volatile organic compounds (VOCs) in onsite groundwater and the lithology between depths of about 55 feet and 94 feet below ground surface, in order to evaluate potential enhancements to the existing onsite treatment system. The 2004 deep soil boring (DB) investigation was intended to assess the presence of VOC-impacted saturated soil in the same areas where the CPTs had provided groundwater data and, separately, to attempt to find the pathway for contaminants to travel from the Benchmark site over to well W20.

As we explained on March 6th, the 2002 CPT data became essentially irrelevant shortly after they were collected because RWQCB and USEPA had signaled to Northrop Grumman that it would be required to install and operate an offsite extraction system to address a large part of the Benchmark plume. The offsite extraction system would capture any contaminants coming from the residual mass remaining onsite, so at least in the short-term it did not make sense to do both. With that decision essentially made for us by RWQCB and USEPA, Northrop Grumman set aside its plan to evaluate potential additional onsite remedial options and turned its attention to designing the offsite extraction system. Had things proceeded as originally planned, the data would have eventually been included in a report to RWQCB explaining what additional onsite work Northrop Grumman intended to undertake.

The situation with the 2004 DB data is not all that different. By the time these data were collected, Northrop Grumman was already committed to installing an offsite extraction system on Valley Boulevard. In addition, Northrop Grumman, RWQCB, and USEPA understood that, absent further onsite work, those Valley Boulevard wells would likely have to operate for 30 years or more. The 2004 DB investigation was intended to supplement the 2002 CPT data and to further Northrop Grumman's understanding of whether there was any onsite work it could cost-effectively undertake to shorten the life of the Valley Boulevard system. That effort too was set aside as Northrop Grumman continued with the design and installation of the offsite system. It was Northrop Grumman's intention at the time to revisit the question of what more could be done onsite after the offsite system was up and running. We could not have predicted in 2004 that the offsite system would still not be operating in 2012.

Northrop Grumman was not Hiding the Data

It is true that both the 2002 CPT data and the 2004 DB data were collected voluntarily by Northrop Grumman and were not provided to RWQCB immediately after collection, but neither was Northrop Grumman hiding from RWQCB the fact that it had collected these data. In fact, quite the opposite is true. Northrop Grumman discussed the 2002 CPT investigation in its Groundwater Monitoring Report submitted to RWQCB for the May 2003 Semiannual Event (report dated November 2003) and some of the CPT and DB data were clearly shown on cross sections that were included as part of the June 2005 Remedial Action Plan, March 2006 Downgradient Groundwater Extraction System Report, and June 2007 Groundwater Extraction Well Installation Report.
If at any time RWQCB had asked Northrop Grumman to prepare reports based solely on these data or submit the raw data, Northrop Grumman would have done so. Similarly, Northrop Grumman did not hesitate to produce these data in 2011 when it became evident that the data would be of interest to the Department of Toxic Substances Control (DTSC). If Northrop Grumman had been trying to hide or suppress these data, it would not have mentioned them in the early reports (2003 to 2007) to

RWQCB nor would it have provided them in December 2011 to DTSC. We were not hiding the data then, and we are not hiding them now. USEPA's implication that either Northrop Grumman or its consultants might have violated some moral, ethical or professional standard by not submitting these data sooner is therefore unwarranted and unfair. We would ask that USEPA stop making such insinuations to us, to our consultants, and to third parties.

The 2002 CPT and 2004 DB Data Confirmed Existing Suspicions about the Conditions at the Benchmark Site

Northrop Grumman understands and appreciates USEPA's consternation at the idea that a responsible party would collect data without telling the regulator and then not share the data. As we explained on March 6th, while it is not uncommon for Northrop Grumman to collect data voluntarily and without necessarily advising the oversight agency first, it is rare for those data not to eventually make their way into a report that is submitted to the oversight agency. We hope that the explanation provided above will help to alleviate USEPA's fears that Northrop Grumman was intentionally hiding the data.

We think USEPA's strong negative reaction to the late submission of the data is also in large part due to USEPA's perception that the data were somehow "game changing." In other words, that if the data had been shared with RWQCB and/or USEPA in 2002 and 2004, something different might have happened with the Benchmark remedy. The 2002 CPT data and the 2004 DB did provide important and valuable information about the onsite conditions at Benchmark that Northrop Grumman did not previously have. Clearly these data confirmed what Northrop Grumman, RWQCB, and USEPA had previously suspected – that there was some residual mass still at the Benchmark site that was slowly bleeding into the groundwater and was not being captured by the existing onsite groundwater pump-and-treat system. The real value of the data were that they allowed Northrop Grumman to begin to quantify the magnitude of the onsite problem.

The record shows that, as early as August 2002, RWQCB and USEPA shared the view that contaminants were migrating both laterally and vertically from Benchmark in spite of the onsite extraction system. This is evident from the Cleanup and Abatement Order (CAO) issued by RWQCB in October 2003, which explicitly states this concern. We also know that USEPA and RWQCB were working on a draft of the CAO as early as August 2002, that Northrop Grumman was informed by RWQCB in February 2003 of its intent to issue a new CAO to Northrop Grumman for the Benchmark site, and that Northrop Grumman was aware of USEPA's intent to transfer five of the nine Puente Valley Operable Unit (PVOU) SZ wells to Northrop Grumman by May 2003. In the several months of negotiations that followed the issuance and then rescission of RWQCB's October 2003 CAO, it was clear that all three parties understood that some subset of the regional SZ system was going to have to operate for as many as 30 years due to continuous migration of contaminants from the Benchmark site, whether those wells were operated by Northrop Grumman as a Benchmark remedy or operated by

USEPA or United Technologies Corporation as part of the SZ remedy. The need to operate these wells for 30 or more years can only be explained by the presence of residual mass onsite at the Benchmark facility that was not being captured by the onsite extraction system. The 2002 CPT and 2004 DB data merely confirmed what was already widely suspected and openly discussed by Northrop Grumman, USEPA, and RWQCB. It was not "game changing" information.

Neither the Absence of Additional Onsite Action nor Delay in Starting up the Offsite Benchmark System is the Reason the Toe of the SZ Plume has Expanded

USEPA has implied on more than one occasion, since learning about the 2002 CPT and 2004 DB data, that the absence of these data is somehow responsible for the toe of the regional SZ groundwater plume expanding. Northrop Grumman would like to point out that the Benchmark site probably began releasing VOCs to regional groundwater in the early 1960s – long before any onsite remediation and long before the DSI data were collected –, and it is these early releases that are now responsible for the expansion of the toe of the SZ plume, not the contamination that left the site any time within the last decade. Even if Northrop Grumman had been able to begin operating the offsite Benchmark extraction system in 2006 or 2007, so long as the SZ remedy north of Puente Creek was not operational, then the SZ plume would have expanded just as it has. It is certainly true that more contaminants have migrated offsite as a result of the delay, but the cause of that delay cannot be placed at the feet of Northrop Grumman. As USEPA well knows, the reason for the delay in starting up the extraction system on Nelson Avenue is entirely due to the presence of naturally-occurring selenium in groundwater at levels that prevent Northrop Grumman from discharging the treated groundwater to Puente Creek. We would also like to remind USEPA that the groundwater contamination in the Intermediate Zone (IZ), which is the result of releases from up-valley sources and will be addressed by the IZ remedy being implemented by Northrop Grumman, has also continued to migrate into and within the mouth of valley area during the delay in start-up of the regional PVOU remedies.

USEPA's Modeling Questions

We believe the memorandum from CDM Smith is self-explanatory and answers all of USEPA's questions about what "modeling" CDM Smith has done on the Benchmark site. We have attempted to clarify in the memorandum what CDM Smith considers "modeling" and what it does not, so that we are all speaking the same language. It became apparent to Northrop Grumman as we talked with you on March 6th and investigated CDM's role in the 2003-2004 Benchmark CAO negotiations, that our initial definition of "modeling" might have been more narrow than USEPA's definition. Accordingly, CDM Smith's memorandum discusses various times over the years that it has been asked by Northrop Grumman to provide some support to issues specific to the Benchmark site. We trust this answers USEPA's questions, but if not please let us know.

Finally, since our meeting on March 6th, we have learned that CDM Smith was given the 2002 CPT data in 2004 and reviewed them, but determined that no changes were appropriate to make to the model as a result of that review. The data were sent to CDM Smith in anticipation of having some Benchmark-specific numerical modeling done to assist Northrop Grumman with an evaluation of the cost-effectiveness of further onsite remediation as compared to operating the Valley Boulevard system for a longer period of time. No one involved with the project recalled that this had occurred, so we wanted to be sure to correct prior statements, if any, by Northrop Grumman or its consultants indicating that we did not believe CDM Smith had received these data until much more recently.

Summary

In closing, please understand that Northrop Grumman and its consultants value very much our reputation with USEPA, DTSC, RWQCB, and the many other PVOU stakeholders. This strong defense of our past actions and decisions is intended to facilitate a return of our relationship with the agencies to one of mutual trust. We understand that actions speak louder than words, and we intend to follow up these words with appropriate actions. In that regard, Northrop Grumman fully supports the agencies' stated intention to conduct reasonable additional investigation at and downgradient of the Benchmark site and even to require additional appropriate onsite remediation.

We trust that this letter and enclosures satisfy your 6 March 2012 request, but if you have any questions or concerns regarding the information provided here, please do not hesitate to contact me at (703) 280-4035.

Sincerely,

Joseph P. Kwan
Corporate Director, Environmental Remediation
on behalf of Northrop Grumman Systems Corporation

Enclosures

cc: Kelly Manheimer - USEPA
Lewis Maldonado - USEPA
Peter MacNicholl - DTSC
Elizabeth Brown - Northrop Grumman

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Memorandum

To: Joseph Kwan, Northrop Grumman Corporation

Copy: Linda Niemeyer, Northrop Grumman Corporation
Rick Lewis, Northrop Grumman Corporation

From: Mike Purchase, Orion Environmental Inc.
Matthew Nelson, Orion Environmental Inc.

Date: 16 March 2012

Subject: Summary Deep Source Investigations Conducted in 2002 and 2004 Former TRW-Benchmark Site, City of Industry, California

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Orion Environmental Inc. (Orion) has prepared this memorandum to summarize soil and groundwater investigations conducted at the former TRW Benchmark site in 2002 and 2004. This memorandum was requested by the U.S. Environmental Protection Agency (USEPA) in emails dated 26 January 2012 and 6 March 2012.

In 2002, a deep source area investigation was conducted to assess (1) the lateral and vertical distribution of volatile organic compounds (VOCs) and 1,4-dioxane in groundwater between depths of about 55 up to 94 feet below ground surface (bgs) and (2) the lithology to depths of 75 to 94 feet bgs at the site.

At the time of this investigation, groundwater levels had decreased from an average of approximately 30 feet bgs between 1995 and 1999 to approximately 42 feet bgs in 2002. TRW Inc. (TRW; currently Northrop Grumman Systems Corporation [Northrop Grumman]) conducted the investigation voluntarily to evaluate the potential for enhancing the onsite remedial activities. A work plan was not submitted to the Los Angeles Regional Water Quality Control Board (RWQCB) for this investigation.

In 2004, a deep soil boring investigation was conducted to assess (1) the presence of VOC-impacted saturated soil near former source areas on site and (2) the potential for migration of VOCs (including dense non-aqueous phase liquid [DNAPL]) from the site toward offsite well W20. Well W20 is located west of the site on the former West Coast Sand & Gravel property. Northrop Grumman conducted the investigation activities voluntarily to continue to evaluate the potential for enhancing remedial activities being conducted on site, and to assess the potential for a contaminant pathway to well W20 off site; a work plan was not submitted to the RWQCB.

Background

The former Benchmark facility was demolished and shallow VOC-impacted soil was excavated and treated on site from 1990 to 1992. Additional deeper soil removal actions were conducted to remove and dispose of soil impacted by metals (copper and chromium). An in situ soil vapor extraction (SVE) system was installed in 1992. A total of 34 vapor extraction wells and horizontal vent lines were installed to remediate VOC-impacted vadose zone soil. The wells and horizontal vent lines were connected to two blowers capable of extracting up to 800 cubic feet per minute. The RWQCB issued a no further action letter for vadose zone soil remediation in 1998, but the system was not removed immediately.

TRW (and later Northrop Grumman) continued to operate the SVE system after receiving soil closure in 1998 to enhance cleanup of the saturated zone exposed during low water level periods. The system operated full time, except for downtime due to scheduled maintenance or unscheduled equipment repair, through 2000. In 2001 system cycling began until the system was finally taken out of operation in 2007. A summary of system operation was submitted to the RWQCB in annual status reports.

A groundwater pump-and-treat system was installed at the site in 1996. The extraction wells were located along the northern property boundary in the former source areas and downgradient of a former developer/still. The extraction wells were screened above the historical high water table to 60 feet bgs. In 2002, groundwater levels had decreased from an average of approximately 30 feet bgs between 1995 and 1999 to a low of approximately 42 feet bgs. The daily extraction rate of the system had declined by 50 percent compared to 2001.

Site Geology

The saturated interval beneath the site and vicinity has been subdivided into stratigraphic zones. Three general stratigraphic zones have been defined in the upper 200 feet based on lithology and depth, although the lithology within each zone may be gradational. The zones have been designated, from shallowest to deepest, as Zone A, Zone B, and Zone C.

Zone A is the shallowest zone and was arbitrarily defined as the interval from the water table to 60 feet bgs. This designation was based on the depth of the wells initially installed on site. The thickness of Zone A varies depending on the water table elevation. This depth interval has one or two saturated sand units (depending on water table elevations) and the water table in Zone A wells is typically 6 to 10 feet higher than the potentiometric surface of the next deeper sand unit. Zone A is also the groundwater interval that was remediated by the onsite pump-and-treat system.

The zones below Zone A were defined by permeable intervals. As a result, there are a sequence of unnamed lower permeability interbedded silts and clays beneath Zone A on the Benchmark site.

Zone B is the first relatively permeable (i.e., sandy) interval encountered below a depth of 60 feet that can be correlated between well locations. Zone B strata include predominantly silty sand and sand, interbedded with clay, extending from a depth of about 80-90 to 115 feet bgs beneath the Benchmark site.

Zone C is defined as the most permeable zone identified in the interval between 150 and 200 feet bgs. Boring logs and electric log data indicate that the Zone C interval consists of silty to gravelly sand interbedded with clay. The intervals between Zones A and B and Zones B and C are predominantly fine-grained and contain an interbedded fine-grained sequence of sediments.

Field Investigation Activities

Deep Source Area Investigation
Eight soil borings (CPT-1 through CPT-8) were drilled on site from 2 to 10 December 2002 by Gregg In Situ, Inc., of Signal Hill, California, using a cone penetration test (CPT) rig. Borings were logged continuously using measurements of cone bearing, sleeve friction, and pore water pressure.

One soil boring (CB-CPT4) was drilled adjacent to boring CPT-4 to obtain soil lithology and collect soil samples for physical properties. Boring CB-CPT4 was drilled on 2 and 5 December 2002 by West Hazmat Drilling Corp., of Anaheim, California, using a hollow-stem auger rig. The boring was drilled to a depth of 80 feet and a soil core was collected from 40 to 80 feet bgs.

Figure 2 is a site plan showing the boring locations. The following table summarizes CPT boring depths and rationale for each location. Orion has been unable to find a work plan or other document that provides the rationale for the selection of each location, so the rationale provided below is based on the best recollection of the project team.

Boring	Total Depth (feet bgs)	Rationale for Boring Location
CPT-1	80	Near extraction well W3 and former degreaser with a history of trichloroethene (TCE) use
CPT-2	89	Near extraction well W9 and downgradient of former developer/still with a history of 1,1,1-trichloroethane (TCA) use
CPT-3	90	Between extraction wells W8 and W9 and downgradient of former utility corridor with a history of TCA storage

Boring	Total Depth (feet bgs)	Rationale for Boring Location
CPT-4	90	Near extraction well W8 and downgradient of former utility tunnel with a history of TCA transport
CPT-5	90	Upgradient of former source areas and extraction well W10
CPT-6	90	At former developer/still source with a history of TCA use
CPT-7	90	Downgradient of CPT-6 at former developer/still with a history of TCA use
CPT-8	90	Downgradient of former utility tunnel with a history of TCA transport

A total of 34 grab groundwater samples were collected from the 8 borings. Samples were collected from each interval attempted. Samples collected from four intervals (CPT-4 at 74 feet bgs, CPT-6 at 88 feet bgs, CPT-7 at 80 feet bgs, and CPT-8 at 73 feet bgs) had reduced sample volumes due to limited water entering the sample chamber.

The boring logs are in Attachment A. Field investigation and quality assurance/quality control (QA/QC) procedures for drilling and sampling are in Attachment B.

Deep Soil Boring Investigation
Three soil borings (DB-1 to DB-3) were drilled on site between 30 and 31 July 2004 by Prosonic Corporation (Prosonic), of Signal Hill, California, using sonic drilling techniques. Three additional borings (DB-4 to DB-6) were drilled off site near well W20 between 1 and 2 October 2004 by Prosonic. The sonic rig provided continuous-core soil recovery. The soil cores were placed in approximately 3- to 5-foot-long plastic bags for lithologic logging. Soil samples for chemical analyses were generally collected from the recovered cores at 10-foot intervals in each boring from about 40 feet bgs (the approximate depth of the water table at the time) to the total depth of each boring. However, additional soil samples were collected based on field observations of photoionization detector headspace readings.

Figure 2 is a site plan showing the soil boring locations. The following table summarizes boring depths and rationale for each boring location. Orion has been unable to find a work plan or other document that provides the rationale for the selection of each location, so the rationale provided below is based on the best recollection of the project team.

Boring	Total Depth (ft bgs)	Rationale for Boring Location
DB-1	105	Near extraction well W9 and downgradient of former developer/still with a history of TCA use
DB-2	105	Near extraction well W8 and downgradient of former utility tunnel with a history of TCA transport
DB-3	105	At former developer/still source with a history of TCA use

Boring	Total Depth (ft bgs)	Rationale for Boring Location
DB-4	105	Between onsite well W3 and offsite well W20
DB-5	115	Between onsite well W3 and offsite well W20
DB-6	105	Upgradient of offsite well W20

The boring logs are in Attachment A. Field investigation and QA/QC procedures for drilling and soil sampling are in Attachment B.

Analytical Program
Groundwater and soil samples were delivered to either Centrum Analytical Laboratories, Inc., of Signal Hill, California, or Severn Trent Laboratories, Inc., of Santa Ana, California. Groundwater samples were analyzed for VOCs, including 1,4-dioxane, by USEPA Method 8260B. The groundwater analytical results are presented in Table 1. Selected soil samples were analyzed for VOCs by USEPA Method 8260. The soil analytical results are presented in Table 2. A soil sample from boring DB-3 at 70 feet bgs was also analyzed for metals by USEPA Method 6010B and n-hexane extractable material by USEPA Method 1664A to profile the soil for disposal purposes.

In addition, the soil core from boring CB-CPT4 was submitted to PTS Laboratories, Inc. (PTS), of Santa Fe Springs, California, for the following tests:

- Core logging and photography
- Grain size in accordance with the American Society for Testing and Materials (ASTM) D4464M (laser light scattering)
- Moisture content in accordance with ASTM D2216
- Porosity, bulk density, grain density, and pore fluid saturation using American Petroleum Institute Method RP40
- Hydraulic conductivity using ASTM D5084
- Total organic carbon using Walkley-Black Method.

Chain-of-custody forms, laboratory analytical reports, laboratory QA/QC data, and data validation reports are included in Attachment C. Validation of the data was performed in March 2012.

Investigation Results

Deep Source Area Investigation

The subsurface soil types recorded by the CPT generally consisted of predominately interbedded fine-grained soil from 60 to 80 feet bgs. Boring CPT-4 contained a coarse-grained layer from roughly 64 to 68 feet bgs that was generally not observed in the other CPT borings on the Benchmark property. Soil cores collected from soil boring CB-CPT-4, drilled adjacent to CPT-4, indicate that the predominantly coarse-grained layer extends roughly 5 feet deeper (64 to 73 feet bgs). In general, more sand was observed both east and west of the investigation area as shown by borings CB-CPT-4 and CPT-4 (to the east) and well W20 (to the west). Lithologic cross sections are shown on Figures 3, 4, and 5.

CPT borings located adjacent to groundwater extraction wells contained elevated TCE and 1,1-dichloroethene (1,1-DCE) concentrations in grab groundwater samples collected below the screens of the existing extraction wells. A decrease in TCE and 1,1-DCE concentrations with depth was observed in all CPT borings except for CPT-8. Groundwater concentrations in extraction wells at the time of the investigation were significantly lower than the historical highs observed before the groundwater extraction system was started in 1996. Selected CPT grab groundwater results are discussed below.

CPT-1/W3: The highest TCE concentration (7,400 micrograms per liter [µg/l]) was reported at boring CPT-1, located in the area of extraction well W3, at a depth of 55 to 58 feet bgs. The well screen for well W3 extends from 25 to 55 feet bgs. The highest historical TCE concentration reported at well W3 (73,000 µg/l) was collected in November 1991 before groundwater extraction began in 1996. The TCE concentration in well W3 in December 2002 was 84 µg/l. The next grab groundwater sample collected at CPT-1, from 63 to 66 feet bgs, had a TCE concentration of 130 µg/l.

CPT-6: The highest 1,1-DCE concentration (17,000 µg/l) was reported at boring CPT-6, located near the former developer/still source area, at a depth of 73 to 76 feet bgs. The 1,1-DCE concentration at boring CPT-6 decreased to 19 µg/l at a depth of 85 to 88 feet bgs. This sample depth and the lithology correspond to the permeable interval that has been designated as Zone B at the site.

CPT-2/W9: Downgradient boring CPT-2, located near extraction well W9, had a 1,1-DCE concentration of 9,000 µg/l at a depth of 69 to 72 feet bgs. The well screen for nearby extraction well W9 extends from 30 to 60 feet bgs. The highest historical 1,1-DCE concentration at well W9 was 56,000 µg/l in November 1991, before groundwater extraction began in 1996. At the time of the CPT investigation, the 1,1-DCE concentration in well W9 was 5,600 µg/l.

CPT-8: A 1,1-DCE concentration of 6,000 μg/l was reported at boring CPT-8, located downgradient of the former utility tunnel, at a depth of 62 to 65 feet bgs. The deepest sample collected from boring CPT-8 (77 to 80 feet bgs) had a 1,1-DCE concentration of 3,300 μg/l. A deeper more permeable unit indicative of Zone B was not encountered in CPT-8, which was advanced to 90 feet bgs.

Table 1 summarizes the groundwater analytical results and Figures 3, 4, and 5 show the results on geologic cross sections that also display the lithologic logs from the CPTs. Figures 6 and 7 show the 1,1-DCE and TCE isoconcentration contours in plan view. These contours are based on the highest concentration detected at each CPT, regardless of depth. Historical groundwater analytical results from groundwater monitoring wells and deep SVE wells (Z4 wells) are included in Attachment D with graphs for water levels and VOC concentrations over time for selected wells.

Deep Soil Boring Investigation

The highest TCE concentration (690 micrograms per kilogram [μg/kg]) was reported at boring DB-4, located off site near monitoring well W20, at a depth of 70 feet bgs. Based on lithology, W20 is considered to be completed within the permeable unit designated as Zone B. TCE concentrations were lower (maximum of 260 μg/kg) at borings DB-5 and DB-6, located between boring DB-4 and the site and upgradient of DB-4, respectively. VOCs detected on the West Coast Sand & Gravel property were well below what would have been expected if contamination had migrated from the vicinity of onsite well W3, and/or other onsite sources, to offsite well W20. The highest TCE concentration reported on site was 360 μg/kg at boring DB-1 at a depth of 65 feet bgs. The highest TCE concentration reported below 80 feet bgs on site was 3.0 μg/kg.

Similar to the deep groundwater investigation, the highest 1,1-DCE concentration (1,600 μg/kg) was reported at boring DB-3, located on site near CPT-6 in the former developer/still source area, at a depth of 75 feet bgs. The lithology at this depth consists of relatively fine-grained silts and clays that comprise the interval between Zone A and Zone B. The 1,1-DCE concentration decreased to 9.2 μg/kg at a depth of 80 feet bgs in boring DB-3. 1,1-DCE was not detected below 80 feet bgs at the three borings installed on site. Table 2 summarizes the soil analytical results and Figures 3, 4, and 5 show the results on the cross sections.

Conclusions

The groundwater investigation results indicate the following:

1. The highest VOC concentrations in groundwater were detected in lower permeability soil between Zones A and B, at depths below the extraction

well screen intervals and above the more permeable interval designated as Zone B.

2. The groundwater extraction system removed VOC mass from the higher permeability soil in Zone A, but was unable to remove the residual mass located in the lower permeability soil below the extraction well screens.

3. The next permeable unit beneath Zone A (i.e., Zone B) on site did not appear to be appreciably impacted. This was consistent with the assumption that Zone A contaminants were getting into Zone B as they migrated downgradient of the site.

4. The deep soil boring investigation did not identify a VOC migration pathway from the vicinity of onsite well W3, and/or other onsite sources, to W20.

Northrop Grumman is currently working with USEPA to update the conceptual site model (CSM) for the site. The data presented in this memorandum have been included in the CSM and will be used to evaluate the presence of additional data gaps.

The existing groundwater extraction wells were not yielding groundwater at the time of the investigation, so deeper wells installed in the lower permeability interval below the existing wells were not expected to produce appreciable quantities of groundwater. Groundwater extraction was not considered a viable remedial technology for residual mass in the lower permeability saturated soil. Therefore, permanent deeper wells were not installed.

Alternative remedial actions to enhance the existing onsite pump-and-treat system were considered but not implemented after this investigation. This was decided because the RWQCB informed Northrop Grumman in February 2003 that it intended to require Northrop Grumman to implement an offsite containment remedy downgradient of the site to address the Benchmark contamination. Northrop Grumman subsequently redirected its remedial efforts to prepare for installation of a downgradient extraction system approximately 600 feet north of the site, along Valley Boulevard. The objective of the Valley Boulevard extraction system was to remediate impacted groundwater downgradient of the site, where it had migrated into the deeper more permeable sand units (Zone B). These sand units were anticipated to be capable of sustaining long-term extraction by a pump-and-treat containment system.

Northrop Grumman is currently working with USEPA to propose locations for additional wells to monitor the impacted interval identified in this memorandum.

Report Submittal History

Northrop Grumman mentioned the deep source area investigation in its May 2003 semiannual groundwater monitoring report to the RWQCB. Certain of the CPT and DB data were also shown on cross sections included in various reports submitted to the RWQCB from June 2005 to June 2007. The data provided in this memorandum were also presented to USEPA and Department of Toxic Substances Control (DTSC) in a meeting on 8 December 2011. Northrop Grumman initiated that meeting to provide a presentation of the historical environmental investigation and remedial activities conducted at the site. The data were subsequently provided to DTSC in a memorandum dated 20 January 2012 and to USEPA electronically in an email dated 17 February 2012.

As requested by USEPA in an email dated 6 March 2012, following is a list of the reports submitted by Northrop Grumman regarding the former TRW Benchmark site since the data included in this memorandum were collected. We note below where the CPT and DB data are mentioned in the referenced report.

Report Date	Report Title
6 June 2003	Annual Groundwater Monitoring and Remediation Status Report, December 2002
21 November 2003	Groundwater Monitoring Report, May 2003 Semiannual Event **Note**: Data were not included in this report, but the report stated that a groundwater investigation using a cone penetration test (CPT) rig had been conducted and that the data would be used to evaluate and develop potential future remediation strategies for the site.
April 2004	Annual Groundwater Monitoring and Remediation Status Report, November 2003
September 2004	Groundwater Monitoring Report, May 2004 Semiannual Event
22 March 2005	Annual Groundwater Monitoring and Remediation Status Report, November 2004
1 June 2005	Remedial Action Plan for Valley Boulevard Groundwater Remediation **Note**: Borings CPT-1 and DB-4 are presented on Figure 2-3 cross section.
13 September 2005	Groundwater Monitoring Report, May 2005 Semiannual Event
7 March 2006	Downgradient Groundwater Extraction System **Note**: Boring DB-4 is presented on Figure 3 cross section.
5 April 2006	Annual Groundwater Monitoring and Remediation Status Report, November 2005
26 September 2006	Groundwater Monitoring Report, June 2006 Semiannual Event
30 March 2007	Groundwater Monitoring Report, December 2006 Semiannual Event
11 June 2007	Groundwater Extraction Well Installation Report **Note**: Boring DB-4 is presented on Figure 4 cross section.
7 September 2007	Groundwater Monitoring Report, June 2007 Semiannual Event
21 February 2008	Groundwater Monitoring Report, November 2007 Semiannual Event
12 August 2008	Groundwater Monitoring Report, May 2008 Semiannual Event

Report Date	Report Title
23 March 2009	Groundwater Monitoring Report, November 2008 Semiannual Event
September 2009	Groundwater Monitoring Report, June 2009 Semiannual Event
31 March 2010	Groundwater Monitoring Report, December 2009 Semiannual Event
7 September 2010	Groundwater Monitoring Report, June 2010 Semiannual Event
7 March 2011	Groundwater Monitoring Report, December 2010 Semiannual Event
15 September 2011	Groundwater Monitoring Report, June 2011 Semiannual Event
16 November 2011	Draft Remedial Design Investigation Work Plan
16 November 2011	Draft Remedial Design/Remedial Action Work Plan

Attachments

Table 1 – Groundwater Analytical Results
Table 2 – Soil Analytical Results
Figure 1 – Site Location Map
Figure 2 – Site Plan
Figure 3 – 1,1-DCE Concentrations in 2002 in Groundwater A-A′
Figure 4 – 1,1-DCE Concentrations in 2002 in Groundwater B-B′
Figure 5 – 1,1-DCE Concentrations in 2002 in Groundwater C-C′
Figure 6 – 1,1-DCE Isoconcentration Contour Map December 2002
Figure 7 – TCE Isoconcentration Contour Map December 2002
Attachment A – Boring Logs
Attachment B – Field Investigation and QA/QC Procedures
Attachment C – Laboratory Analytical Reports and Chain-of-Custody Forms
Attachment D – Historical Groundwater Analytical Results
Attachment E – Waste Manifests

TABLE 1

GROUNDWATER ANALYTICAL RESULTS
VERTICAL DELINEATION INVESTIGATION
FORMER TRW BENCHMARK SITE

			Volatile Organic Compounds (µg/l) [a]																					
Location	Sample Interval (feet bgs)	Sample Date	1,1,1-TCA	1,1,2-TCA	PCE	TCE	1,1-DCA	1,2-DCA	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	Methylene Chloride	Vinyl Chloride	Carbon Tetrachloride	Trichloro-fluoromethane	Trichloro-trifluoroethane	Acetone	2-Butanone	Bromoform	Chloroform	Benzene	Total Xylenes	1,4-Dioxane	Total VOCs
CPT-1	55 - 58	12/2/02	22	11	100	7,400	100	2.0	3,100	30	1.7	ND<0.5[b]	0.6	0.6	0.8	1.8	ND<20	ND<10	ND<0.5	6.6	6.4	ND<1.5	640	10,784
(near W3)	63 - 66	12/2/02	2.0	ND<0.5	35	130	9.7	ND<0.5	84	8.9	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<20	ND<10	ND<0.5	0.6	ND<0.5	ND<1.5	ND<100	270
	72 - 75	12/2/02	10	1.7	74	260	48	0.7	330	24	0.9	ND<0.5	ND<0.5	ND<0.5	0.8	0.8	ND<20	ND<10	ND<0.5	1.1	ND<0.5	ND<1.5	290	752
CPT-2	52 - 55	12/2/02	6.3	2.2	57	410	74	1.2	580	15	0.6	ND<0.5	ND<0.5	ND<0.5	0.6	0.7	ND<20	ND<10	ND<0.5	2.1	ND<0.5	ND<1.5	ND<100	1,150
(near W9)	60 - 63	12/2/02	4.7	2.2	30	310	52	1.0	510	12	ND<0.5	0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<20	ND<10	ND<0.5	1.4	ND<0.5	ND<1.5	ND<100	924
	69 - 72	12/2/02	1.1	32	100	3,800	350	24	9,000	14	1.8	12	0.9	3.3	1.7	4.0	ND<20	ND<10	ND<0.5	28	4.2	ND<1.5	ND<500	13,377
	75 - 78	12/2/02	46	35	100	1,000	440	11	5,500	30	2.1	8.3	1.3	1.3	3.1	5.0	ND<20	ND<10	ND<0.5	13	1.9	3.1	530	7,201
	82 - 85	12/9/02	ND<2.5	ND<2.5	ND<2.5	24	ND<2.5	ND<2.5	33	ND<2.5	ND<2.5	ND<250	ND<2.5	ND<2.5	ND<2.5	ND<25	ND<250	ND<25	ND<2.5	ND<2.5	ND<2.5	ND<7.5	ND<500	57
	91 - 94	12/9/02	ND<2.5	ND<2.5	13	210	22	ND<2.5	450	4.0	ND<2.5	ND<250	ND<2.5	ND<2.5	ND<2.5	ND<25	ND<250	ND<25	ND<2.5	ND<2.5	ND<2.5	ND<7.5	ND<500	699
CPT-3	52 - 55	12/9/02	14	8.8	43	240	130	2.4	2,200	12	1.2	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<5	ND<50	ND<5.0	ND<0.5	7.4	1.0	ND<1.5	500	3,160
	64 - 67	12/9/02	ND<2.5	22	34	730	220	9.8	5,200	16	ND<2.5	ND<250	ND<2.5	ND<2.5	ND<2.5	ND<25	ND<250	ND<2.5	ND<2.5	12	ND<2.5	ND<7.5	660	6,904
	70 - 73	12/9/02	ND<2.5	ND<2.5	54	150	81	ND<2.5	990	14	ND<2.5	ND<250	ND<2.5	ND<2.5	ND<2.5	ND<25	ND<250	ND<2.5	ND<2.5	ND<2.5	ND<2.5	ND<7.5	ND<500	1,289
	79 - 82	12/9/02	ND<0.5	ND<0.5	1.3	120	4.5	ND<0.5	210	ND<0.5	ND<0.5	ND<50	ND<0.5	ND<0.5	3.6	ND<5	ND<50	ND<5.0	ND<0.5	1.3	ND<0.5	ND<1.5	ND<100	341
CPT-4	52 - 55	12/3/02	4.7	1.2	45	320	32	ND<0.5	42	11	0.6	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<20	ND<10	ND<0.5	ND<0.5	ND<0.5	ND<1.5	ND<100	457
(near W8)	65 - 68	12/3/02	ND<25	ND<25	42	190	110	ND<25	2,100	ND<25	ND<25	ND<25	ND<25	ND<25	ND<25	ND<25	ND<1,000	ND<500	ND<25	ND<25	ND<25	ND<75	ND<100	2,442
	71 - 74	12/3/02	0.9	1.3	14	15	7.6	1.4	36	4.4	ND<0.5	ND<0.5	ND<0.5	ND<0.5	0.9	ND<0.5	170	13	ND<0.5	0.8	ND<0.5	ND<1.5	NA[c]	265
	78 - 81	12/3/02	ND<0.5	ND<0.5	4.2	58	5.9	ND<0.5	140	0.9	ND<0.5	ND<0.5	ND<0.5	ND<0.5	3.4	0.5	44	ND<10	ND<0.5	ND<0.5	ND<0.5	ND<1.5	ND<100	257
CPT-5	55 - 58	12/10/02	ND<0.5	ND<0.5	37	12	0.9	ND<0.5	2.5	8.7	ND<0.5	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<5	ND<50	ND<5	ND<0.5	ND<0.5	ND<0.5	ND<1.5	ND<100	61
	63 - 66	12/10/02	ND<0.5	ND<0.5	23	19	3.7	ND<0.5	17	6.7	ND<0.5	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<5	ND<50	ND<5	ND<0.5	ND<0.5	ND<0.5	ND<1.5	ND<100	69
	73 - 76	12/10/02	17	0.6	84	40	19	ND<0.5	140	18	0.6	ND<50	ND<0.5	ND<0.5	1.1	ND<5	ND<50	ND<5	ND<0.5	ND<0.5	ND<0.5	ND<1.5	200	320
	79 - 82	12/10/02	2.0	ND<1.0	25	62	6.5	ND<1.0	120	4.9	ND<1.0	ND<100	ND<1.0	ND<1.0	4.4	ND<10	ND<100	ND<10	ND<1.0	ND<1.0	ND<1.0	ND<3.0	ND<200	225
CPT-6	52 - 55	12/10/02	1.3	ND<0.5	16	380	37	ND<0.5	680	5.0	ND<0.5	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<5	ND<50	ND<5	ND<0.5	ND<0.5	ND<0.5	ND<1.5	ND<100	1,119
(upgradient of CPT-7)	62 - 65	12/10/02	ND<10	ND<10	47	430	200	ND<10	1,500	27	ND<10	ND<1,000	ND<10	ND<10	ND<10	ND<100	ND<1,000	ND<100	ND<10	ND<10	ND<10	ND<30	ND<2,000	2,204
	73 - 76	12/10/02	ND<10	16	95	980	330	ND<10	17,000	32	ND<10	ND<1,000	ND<10	ND<10	ND<10	ND<100	ND<1,000	ND<100	ND<10	ND<10	ND<10	ND<30	ND<2,000	18,453
	78 - 81	12/10/02	ND<5.0	15	42	530	210	ND<5.0	6,500	21	ND<5.0	ND<500	ND<5.0	ND<5.0	ND<5.0	ND<50	ND<500	ND<50	ND<5.0	10	ND<5.0	ND<15	ND<1,000	7,328
	85 - 88	12/10/02	ND<0.5	ND<0.5	ND<0.5	7.6	ND<0.5	ND<0.5	19	ND<0.5	ND<0.5	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<5	ND<50	ND<5	ND<0.5	ND<0.5	ND<0.5	ND<1.5	ND<100	27
CPT-7	50 - 53	12/3/02	ND<25	ND<25	60	1,600	660	ND<25	2,200	30	ND<25	ND<25	ND<25	ND<25	ND<25	ND<25	ND<1,000	ND<500	ND<25	ND<25	ND<25	ND<75	ND<2,000	4,550
(downgradient of dev/still)	60 - 63	12/3/02	3.2	ND<2.5	64	510	69	ND<2.5	550	16	ND<2.5	ND<2.5	ND<2.5	ND<2.5	ND<2.5	ND<2.5	ND<100	ND<500	ND<2.5	ND<2.5	ND<2.5	ND<7.5	ND<200	1,212
	70 - 73	12/3/02	ND<25	26	100	870	330	ND<25	8,500	28	ND<25	28	ND<25	ND<25	ND<25	ND<25	ND<1,000	ND<500	ND<25	ND<25	ND<25	ND<75	ND<5,000	9,882
	77 - 80	12/3/02	ND<0.5	ND<0.5	0.8	39	6.1	ND<0.5	54	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	1.0	ND<0.5	64	ND<10	ND<0.5	0.8	ND<0.5	ND<1.5	ND<100	166
CPT-8	52 - 55	12/9/02	67	15	57	26	58	ND<13	790	ND<13	ND<13	ND<1,250	ND<13	ND<13	ND<13	ND<125	ND<1,250	ND<125	ND<13	ND<13	ND<13	ND<38	ND<2,500	1,013
	62 - 65	12/9/02	12	40	96	440	480	ND<2.5	6,000	42	5.5	ND<250	ND<2.5	ND<2.5	ND<2.5	ND<25	ND<250	ND<25	ND<2.5	10	ND<2.5	ND<7.5	3,500	7,126
	70 - 73	12/9/02	ND<10	34	62	500	300	ND<10	5,700	33	ND<10	ND<1,000	ND<10	ND<10	ND<10	ND<100	ND<1,000	ND<100	ND<10	ND<10	ND<10	ND<30	ND<2,000	6,629
	77 - 80	12/9/02	ND<10	ND<10	120	420	64	ND<10	3,300	ND<10	ND<10	ND<1,000	ND<10	ND<10	ND<10	ND<100	ND<1,000	ND<100	ND<10	ND<10	ND<10	ND<30	ND<2,000	3,904

(a) Volatile organic compounds (VOCs) analyzed by EPA Method 8260B, reported in micrograms per liter (µg/l).
(b) Not detected above the detection limit listed.
(c) Not analyzed.

TABLE 2

SOIL ANALYTICAL RESULTS
FORMER TRW BENCHMARK SITE

Boring	Depth (feet)	Sample Date	Volatile Organic Compounds (µg/kg) [a]																					
			1,1,1-TCA	1,1,2-TCA	PCE	TCE	1,1-DCA	1,2-DCA	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	Methylene Chloride	Vinyl Chloride	Carbon Tetrachloride	Trichloro-fluoromethane	1,1,2-Trichloro-trifluoroethane	Acetone	2-Butanone	Bromoform	Chloroform	Benzene	Total Xylenes	Total VOCs
DB-1	40	7/30/04	ND<4.9[b]	ND<4.9	ND<4.9	ND<4.9	ND<4.9	ND<4.9	ND<4.9	ND<4.9	ND<4.9	ND<4.9	ND<9.8	ND<4.9	ND<9.8	ND<4.9	ND<24	ND<24	ND<4.9	ND<4.9	ND<4.9	ND<4.9	0
	50	7/30/04	ND<4.3	ND<4.3	ND<4.3	12	2.7 J[c][d]	ND<4.3	49	ND<4.3	ND<4.3	ND<4.3	ND<8.6	ND<4.3	ND<8.6	ND<4.3	ND<22	ND<22	ND<4.3	ND<4.3	ND<4.3	ND<4.3	61
	53	7/30/04	ND<210	ND<210	ND<210	210	ND<210	ND<210	400	ND<210	ND<210	ND<210	ND<420	ND<210	ND<210	ND<210	ND<1,000	ND<1,000	ND<210	ND<210	ND<210	ND<210	610
	60	7/30/04	ND<220	ND<220	ND<220	ND<220	ND<220	ND<220	320	ND<220	ND<220	ND<220	ND<430	ND<220	ND<220	ND<220	ND<1,100	ND<1,100	ND<220	ND<220	ND<220	ND<220	320
	65	7/30/04	ND<220	ND<220	ND<220	360	ND<220	ND<220	1,100	ND<220	ND<220	ND<220	ND<440	ND<220	ND<220	ND<220	ND<1,100	ND<1,100	ND<220	ND<220	ND<220	ND<220	1,460
	70	7/30/04	ND<200	ND<200	ND<200	150 J[d]	ND<200	ND<200	380	ND<200	ND<200	ND<200	ND<400	ND<200	ND<200	ND<200	ND<1,000	ND<1,000	ND<200	ND<200	ND<200	ND<200	380
	75	7/30/04	ND<200	ND<200	ND<200	ND<200	ND<200	ND<200	390	ND<200	ND<200	ND<200	ND<390	ND<200	ND<200	ND<200	ND<980	ND<980	ND<200	ND<200	ND<200	ND<200	390
	80	7/30/04	ND<4.4	ND<4.4	ND<4.4	11	1.0 J[d]	ND<4.4	37	ND<4.4	ND<4.4	ND<4.4	ND<8.8	ND<4.4	ND<8.8	ND<4.4	ND<22	ND<22	ND<4.4	ND<4.4	ND<4.4	ND<4.4	48
	85	7/30/04	ND<4	ND<4	ND<4	ND<4	ND<4	ND<4	ND<4	ND<4	ND<4	ND<4	ND<8.1	ND<4	ND<8.1	ND<4	ND<20	ND<20	ND<4	ND<4	ND<4	ND<4	0
	90	7/30/04	ND<4.2	ND<4.2	2.1 J	ND<4.2	ND<4.2	ND<4.2	ND<4.2	ND<4.2	ND<4.2	ND<4.2	ND<8.3	ND<4.2	ND<8.3	ND<4.2	ND<21	ND<21	ND<4.2	ND<4.2	ND<4.2	ND<4.2	0
	95	7/30/04	ND<4.2	ND<4.2	ND<4.2	ND<4.2	ND<4.2	ND<4.2	ND<4.2	ND<4.2	ND<4.2	ND<4.2	ND<8.3	ND<4.2	ND<8.3	ND<4.2	ND<21	ND<21	ND<4.2	ND<4.2	ND<4.2	ND<4.2	0
	100	7/30/04	ND<3.8	ND<3.8	ND<3.8	ND<3.8	ND<3.8	ND<3.8	ND<3.8	ND<3.8	ND<3.8	ND<3.8	ND<7.6	ND<3.8	ND<7.6	ND<3.8	ND<19	ND<19	ND<3.8	ND<3.8	ND<3.8	ND<3.8	0
	105	7/30/04	ND<4.4	ND<4.4	2.3 J[d]	3.0 J[d]	ND<4.4	ND<4.4	ND<4.4	ND<4.4	ND<4.4	ND<4.4	ND<8.7	ND<4.4	ND<8.7	ND<4.4	19 J	ND<22	ND<4.4	ND<4.4	ND<4.4	ND<4.4	0
DB-2	40	7/30/04	ND<5.3	ND<5.3	ND<5.3	ND<5.3	ND<5.3	ND<5.3	ND<5.3	ND<5.3	ND<5.3	ND<5.3	ND<11	ND<5.3	ND<11	ND<5.3	ND<26	ND<26	ND<5.3	ND<5.3	ND<5.3	ND<5.3	0
	50	7/30/04	ND<3.8	ND<3.8	ND<3.8	3.3 J[d]	11	ND<3.8	22	ND<3.8	ND<3.8	ND<3.8	ND<7.6	ND<3.8	ND<7.6	ND<3.8	ND<19	ND<19	ND<3.8	ND<3.8	ND<3.8	ND<3.8	33
	60	7/30/04	ND<4.6	ND<4.6	9.2	44	4.4 J[d]	ND<4.6	11	ND<4.6	ND<4.6	ND<4.6	ND<9.2	ND<4.6	ND<9.2	ND<4.6	ND<23	ND<23	ND<4.6	ND<4.6	ND<4.6	ND<4.6	64
	65	7/30/04	ND<4.8	ND<4.8	ND<4.8	3.0 J[d]	3.5 J[d]	ND<4.8	6.4	ND<4.8	ND<4.8	ND<4.8	ND<9.7	ND<4.8	ND<9.7	ND<4.8	ND<24	ND<24	ND<4.8	ND<4.8	ND<4.8	ND<4.8	6
	70	7/30/04	ND<3.9	ND<3.9	4.6[d]	5.2[d]	1.2 J[d]	ND<3.9	31[d]	ND<3.9	ND<3.9	ND<3.9	ND<7.8	ND<3.9	ND<7.8	ND<3.9	ND<20	ND<20	ND<3.9	ND<3.9	ND<3.9	ND<3.9	0
	75	7/30/04	ND<4	ND<4	2.8 J[d]	13	2.8 J[d]	ND<4	57	ND<4	ND<4	ND<4	ND<8	ND<4	ND<8	ND<4	ND<20	ND<20	ND<4	ND<4	ND<4	ND<4	70
	80	7/30/04	ND<3.9	ND<3.9	ND<3.9	4.4[d]	ND<3.9	ND<3.9	7.6[d]	ND<3.9	ND<3.9	ND<3.9	ND<7.8	ND<3.9	ND<7.8	ND<3.9	ND<20	ND<20	ND<3.9	ND<3.9	ND<3.9	ND<3.9	0
	85	7/30/04	ND<4.3	ND<4.3	ND<4.3	ND<4.3	ND<4.3	ND<4.3	ND<4.3	ND<4.3	ND<4.3	ND<4.3	ND<8.6	ND<4.3	ND<8.6	ND<4.3	ND<22	ND<22	ND<4.3	ND<4.3	ND<4.3	ND<4.3	0
	90	7/30/04	ND<4.4	ND<4.4	ND<4.4	ND<4.4	ND<4.4	ND<4.4	ND<4.4	ND<4.4	ND<4.4	ND<4.4	ND<8.8	ND<4.4	ND<8.8	ND<4.4	ND<22	ND<22	ND<4.4	ND<4.4	ND<4.4	ND<4.4	0
	95	7/30/04	ND<4	ND<4	ND<4	ND<4	ND<4	ND<4	ND<4	ND<4	ND<4	ND<4	ND<8.1	ND<4	ND<8.1	ND<4	ND<20	ND<20	ND<4	ND<4	ND<4	ND<4	0
	100	7/30/04	ND<4.6	ND<4.6	3.6 J[d]	2.5 J[d]	ND<4.6	ND<4.6	ND<4.6	ND<4.6	ND<4.6	ND<4.6	ND<9.3	ND<4.6	ND<9.3	ND<4.6	ND<23	ND<23	ND<4.6	ND<4.6	ND<4.6	ND<4.6	0
	105	7/30/04	ND<4.9	ND<4.9	ND<4.9	ND<4.9	ND<4.9	ND<4.9	ND<4.9	ND<4.9	ND<4.9	ND<4.9	ND<9.8	ND<4.9	ND<9.8	ND<4.9	ND<24	ND<24	ND<4.9	ND<4.9	ND<4.9	ND<4.9	0
DB-3	40	7/31/04	ND<4.6	ND<4.6	ND<4.6	2.1 J[d]	ND<4.6	ND<4.6	ND<4.6	ND<4.6	ND<4.6	ND<4.6	ND<9.2	ND<4.6	ND<9.2	ND<4.6	15 J[d]	ND<23	ND<4.6	ND<4.6	ND<4.6	ND<4.6	0
	50	7/31/04	ND<4.1	ND<4.1	3.4 J[d]	72	26	ND<4.1	70	ND<4.1	ND<4.1	ND<4.1	ND<8.2	ND<4.1	ND<8.2	ND<4.1	ND<20	ND<20	ND<4.1	ND<4.1	ND<4.1	ND<4.1	168
	60	7/31/04	ND<220	ND<220	ND<220	ND<220	ND<220	ND<220	460	ND<220	ND<220	ND<220	ND<430	ND<220	ND<220	ND<220	ND<1,100	ND<1,100	ND<220	ND<220	ND<220	ND<220	460
	65	7/31/04	ND<210	ND<210	ND<210	ND<210	ND<210	ND<210	180 J[d]	ND<210	ND<210	ND<210	ND<420	ND<210	ND<210	ND<210	ND<1,000	ND<1,000	ND<210	ND<210	ND<210	ND<210	0
	70	7/31/04	ND<220	ND<220	ND<220	120 J[d]	ND<220	ND<220	1,300[d]	ND<220	ND<220	ND<220	ND<430	ND<220	ND<220	ND<220	ND<1,100	ND<1,100	ND<220	ND<220	ND<220	ND<220	1,300
	75	7/31/04	ND<220	ND<220	ND<220	160 J[d]	ND<220	ND<220	1,600	ND<220	ND<220	ND<220	ND<450	ND<220	ND<220	ND<220	ND<1,100	ND<1,100	ND<220	ND<220	ND<220	ND<220	1,600
	80	7/31/04	ND<4	ND<4	ND<4	5.7[d]	ND<4	ND<4	9.2[d]	ND<4	ND<4	ND<4	ND<8	ND<4	ND<8	ND<4	ND<20	ND<20	ND<4	ND<4	ND<4	ND<4	0
	85	7/31/04	ND<3.9	ND<3.9	ND<3.9	ND<3.9	ND<3.9	ND<3.9	ND<3.9	ND<3.9	ND<3.9	ND<3.9	ND<7.8	ND<3.9	ND<7.8	ND<3.9	ND<20	ND<20	ND<3.9	ND<3.9	ND<3.9	ND<3.9	0
	90	7/31/04	ND<4.2	ND<4.2	ND<4.2	ND<4.2	ND<4.2	ND<4.2	ND<4.2	ND<4.2	ND<4.2	ND<4.2	ND<8.3	ND<4.2	ND<8.3	ND<4.2	ND<21	ND<21	ND<4.2	ND<4.2	ND<4.2	ND<4.2	0

TABLE 2

SOIL ANALYTICAL RESULTS
FORMER TRW BENCHMARK SITE

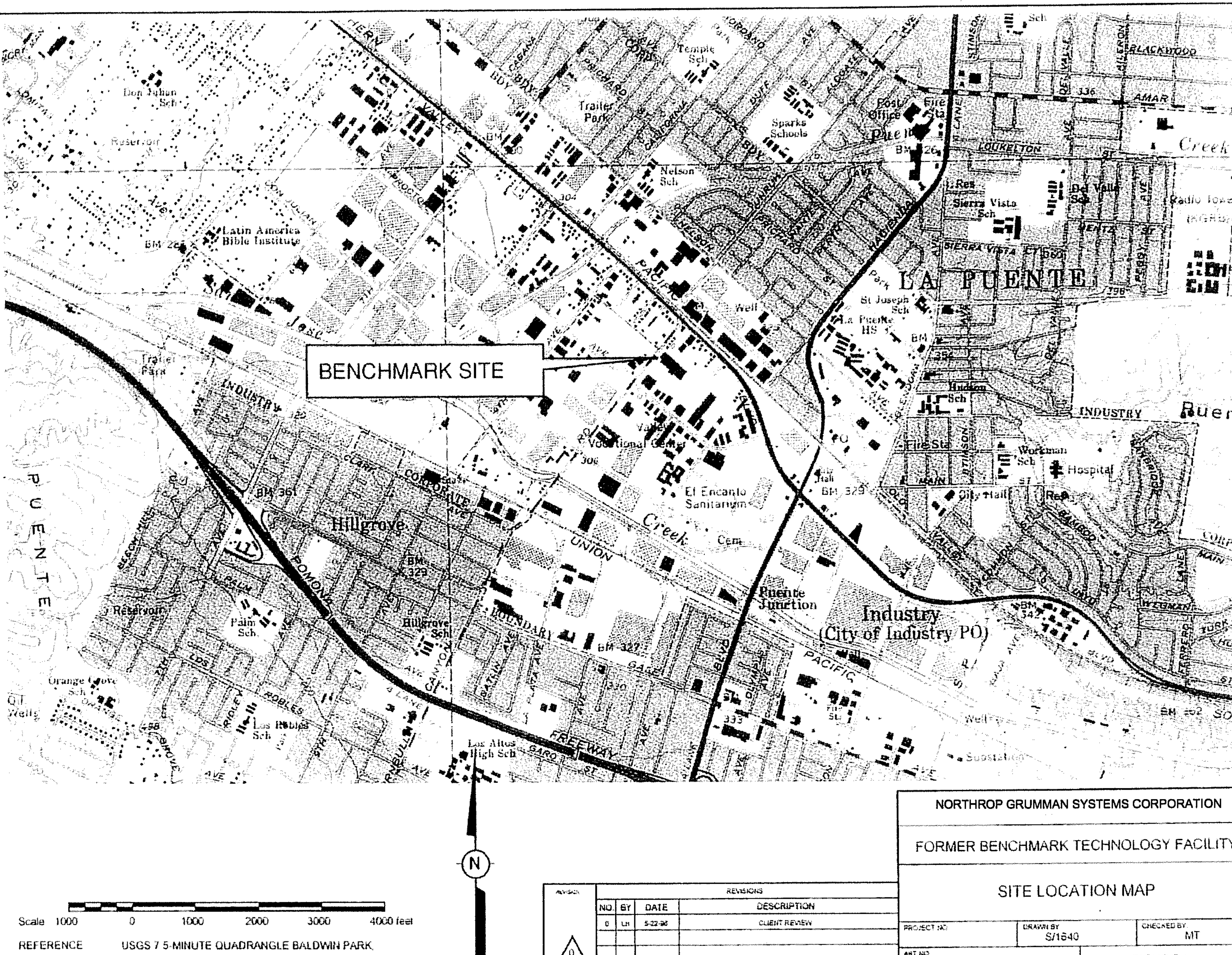
Boring	Depth (feet)	Sample Date	Volatile Organic Compounds (µg/kg) [a]																				
			1,1,1-TCA	1,1,2-TCA	PCE	TCE	1,1-DCA	1,2-DCA	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	Methylene Chloride	Vinyl Chloride	Carbon Tetrachloride	Trichloro-fluoromethane	1,1,2-Trichloro-trifluoroethane	Acetone	2-Butanone	Bromoform	Chloroform	Benzene	Total Xylenes	Total VOCs
DB-3	95	7/31/04	ND<4.3	ND<4.3	ND<4.3	ND<4.3	ND<4.3	ND<4.3	ND<4.3	ND<4.3	ND<4.3	ND<4.3	ND<8.6	ND<4.3	ND<8.6	ND<4.3	ND<22	ND<22	ND<4.3	ND<4.3	ND<4.3	ND<4.3	0
(cont.)	100	7/31/04	ND<3.8	ND<3.8	ND<3.8	ND<3.8	56	ND<3.8	ND<3.8	ND<3.8	ND<3.8	ND<3.8	ND<7.7	ND<3.8	ND<7.7	ND<3.8	ND<19	ND<19	ND<3.8	ND<3.8	ND<3.8	ND<3.8	56
	105	7/31/04	ND<4	ND<4	ND<4	ND<4	ND<4	ND<4	ND<4	ND<4	ND<4	ND<4	ND<8	ND<4	ND<8	ND<4	ND<20	ND<20	ND<4	ND<4	ND<4	ND<4	0
DB-4	30	10/1/04	ND<1	ND<3	ND<1	ND<1	ND<1	ND<1	ND<5	ND<2	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	0
	40	10/1/04	ND<1	ND<3	ND<1	ND<1	ND<1	ND<1	ND<5	ND<2	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	0
	50	10/1/04	ND<1	ND<3	3	2	ND<1	ND<1	ND<5	ND<2	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	5
	60	10/1/04	ND<1	ND<3	8	36	7	ND<1	51	3	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	105
	65	10/1/04	ND<1	ND<3	7	110	10	ND<1	79	3	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	209
	70	10/1/04	ND<1	ND<3	13	690	30	2	340	6	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	1	ND<2	1,082
	75	10/1/04	ND<1	ND<3	5	450	15	ND<1	120	3	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	593
	80	10/1/04	ND<1	ND<3	2	98	6	ND<1	47	ND<2	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	153
	85	10/1/04	ND<1	ND<3	ND<1	2	ND<1	ND<1	ND<5	ND<2	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	2
	90	10/1/04	ND<1	ND<3	ND<1	ND<1	ND<1	ND<1	ND<5	ND<2	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	0
	95	10/1/04	ND<1	ND<3	ND<1	ND<1	ND<1	ND<1	ND<5	ND<2	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	0
	100	10/1/04	ND<1	ND<3	ND<1	7	ND<1	ND<1	ND<5	ND<2	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	7
	105	10/1/04	ND<1	ND<3	ND<1	ND<1	ND<1	ND<1	ND<5	ND<2	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	0
DB-5	30	10/1/04	ND<1	ND<3	ND<1	ND<1	ND<1	ND<1	ND<5	ND<2	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	0
	40	10/1/04	ND<1	ND<3	ND<1	ND<1	ND<1	ND<1	ND<5	ND<2	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	0
	50	10/1/04	ND<1	ND<3	3	6	1	ND<1	ND<5	ND<2	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	10
	60	10/2/04	ND<1	ND<3	7	49	7	ND<1	83	3	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	149
	65	10/2/04	ND<1	ND<3	6	260	11	ND<1	110	3	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	390
	70	10/2/04	ND<1	ND<3	7	170	12	ND<1	140	2	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	331
	75	10/2/04	ND<1	ND<3	5	120	8	ND<1	90	ND<2	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	223
	80	10/2/04	ND<1	ND<3	2	69	5	ND<1	43	ND<2	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	119
	85	10/2/04	ND<1	ND<3	ND<1	76	3	ND<1	40	ND<2	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	119
	90	10/2/04	ND<1	ND<3	3	4	ND<1	ND<1	ND<5	ND<2	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	7
	95	10/2/04	ND<1	ND<3	2	2	ND<1	ND<1	ND<5	ND<2	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	4
	100	10/2/04	ND<1	ND<3	1	2	ND<1	ND<1	5	ND<2	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	8
	105	10/2/04	ND<1	ND<3	ND<1	ND<1	ND<1	ND<1	ND<5	ND<2	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	0
	110	10/2/04	ND<1	ND<3	ND<1	ND<1	ND<1	ND<1	ND<5	ND<2	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	0
	115	10/2/04	ND<1	ND<3	ND<1	ND<1	ND<1	ND<1	ND<5	ND<2	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	0
DB-6	30	10/2/04	ND<1	ND<3	ND<1	ND<1	ND<1	ND<1	ND<5	ND<2	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	0
	40	10/2/04	ND<1	ND<3	ND<1	ND<1	ND<1	ND<1	ND<5	ND<2	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	0
	50	10/2/04	ND<1	ND<3	5	6	1	ND<1	5	ND<2	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	17

TABLE 2

SOIL ANALYTICAL RESULTS
FORMER TRW BENCHMARK SITE

Boring	Depth (feet)	Sample Date	Volatile Organic Compounds (µg/kg) [a]																					
			1,1,1-TCA	1,1,2-TCA	PCE	TCE	1,1-DCA	1,2-DCA	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	Methylene Chloride	Vinyl Chloride	Carbon Tetrachloride	Trichloro-fluoromethane	1,1,2-Trichloro-trifluoroethane	Acetone	2-Butanone	Bromoform	Chloroform	Benzene	Total Xylenes	Total VOCs
DB-6	60	10/2/04	ND<1	ND<3	3	17	2	ND<1	14	ND<2	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	36
(cont.)	65	10/2/04	ND<1	ND<3	3	11	2	ND<1	9	ND<2	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	25
	70	10/2/04	ND<1	ND<3	8	67	6	ND<1	63	3	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	147
	75	10/2/04	ND<1	ND<3	13	230	22	ND<1	160	5	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	430
	80	10/2/04	ND<1	ND<3	ND<1	65	1	ND<1	29	ND<2	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	95
	85	10/2/04	ND<1	ND<3	ND<1	4	ND<1	ND<1	ND<5	ND<2	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	4
	90	10/2/04	ND<1	ND<3	ND<1	25	ND<1	ND<1	13	ND<2	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	38
	95	10/2/04	ND<1	ND<3	4	3	ND<1	ND<1	ND<5	ND<2	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	7
	100	10/2/04	ND<1	ND<3	ND<1	2	ND<1	ND<1	ND<5	ND<2	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	2
	105	10/2/04	ND<1	ND<3	ND<1	ND<1	ND<1	ND<1	ND<5	ND<2	ND<2	ND<50	ND<2	ND<1	ND<1	ND<5	ND<50	ND<10	ND<5	ND<2	ND<1	ND<2	0

(a) Volatile organic compounds (VOCs) analyzed by EPA Method 8260B, reported in micrograms per kilogram (µg/kg).
(b) Not detected above the detection limit listed.
(c) J-flagged result is estimated and detected below the reporting limit.
(d) Results indicated as "estimated" based on data validation.



Scale 1000 0 1000 2000 3000 4000 feet

REFERENCE USGS 7.5-MINUTE QUADRANGLE BALDWIN PARK, CALIFORNIA DATED 1964, PHOTO REVISED 1981.

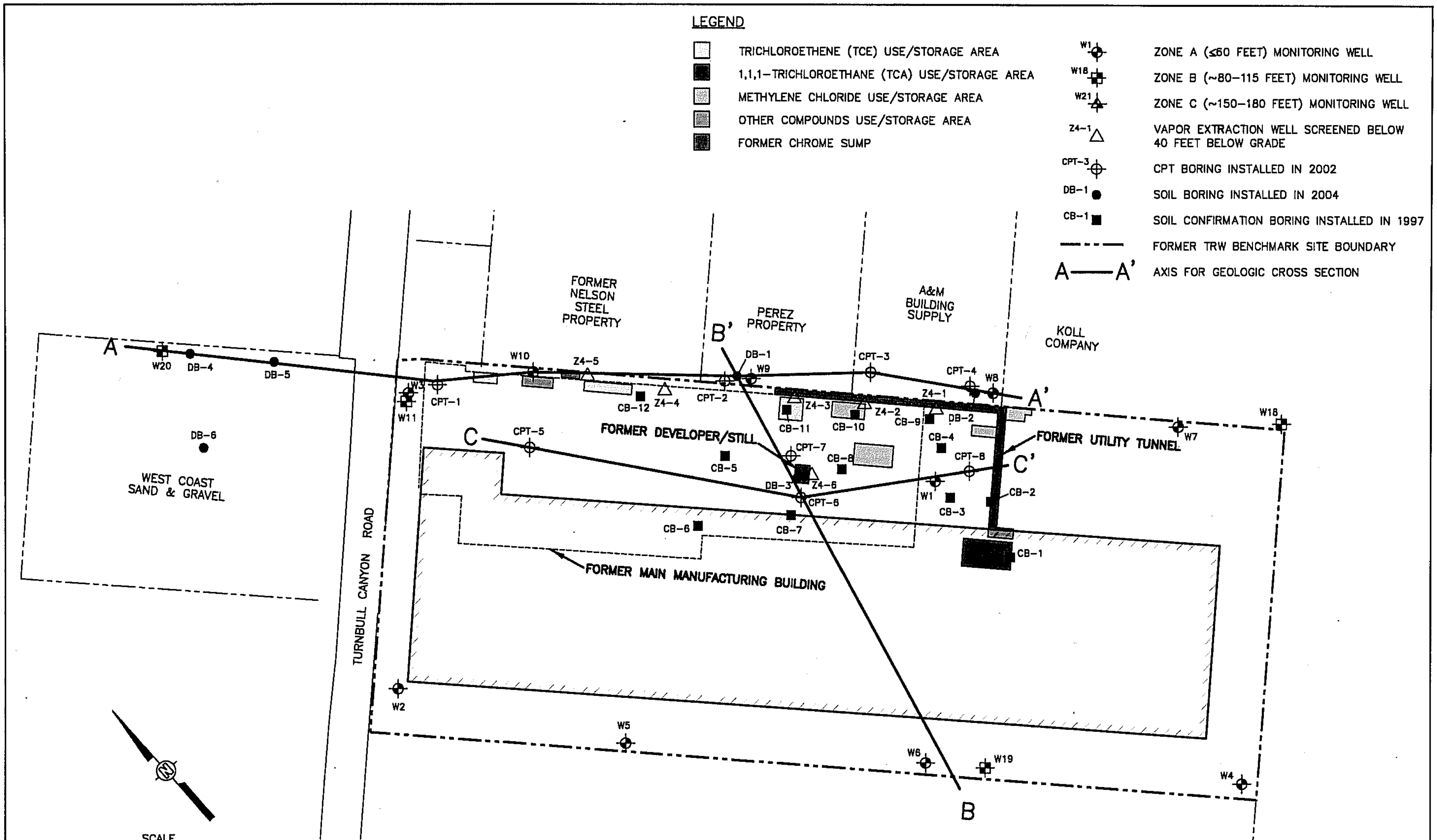
REVISION	REVISIONS			
	NO.	BY	DATE	DESCRIPTION
0	0	LH	5-22-96	CLIENT REVIEW

NORTHROP GRUMMAN SYSTEMS CORPORATION

FORMER BENCHMARK TECHNOLOGY FACILITY

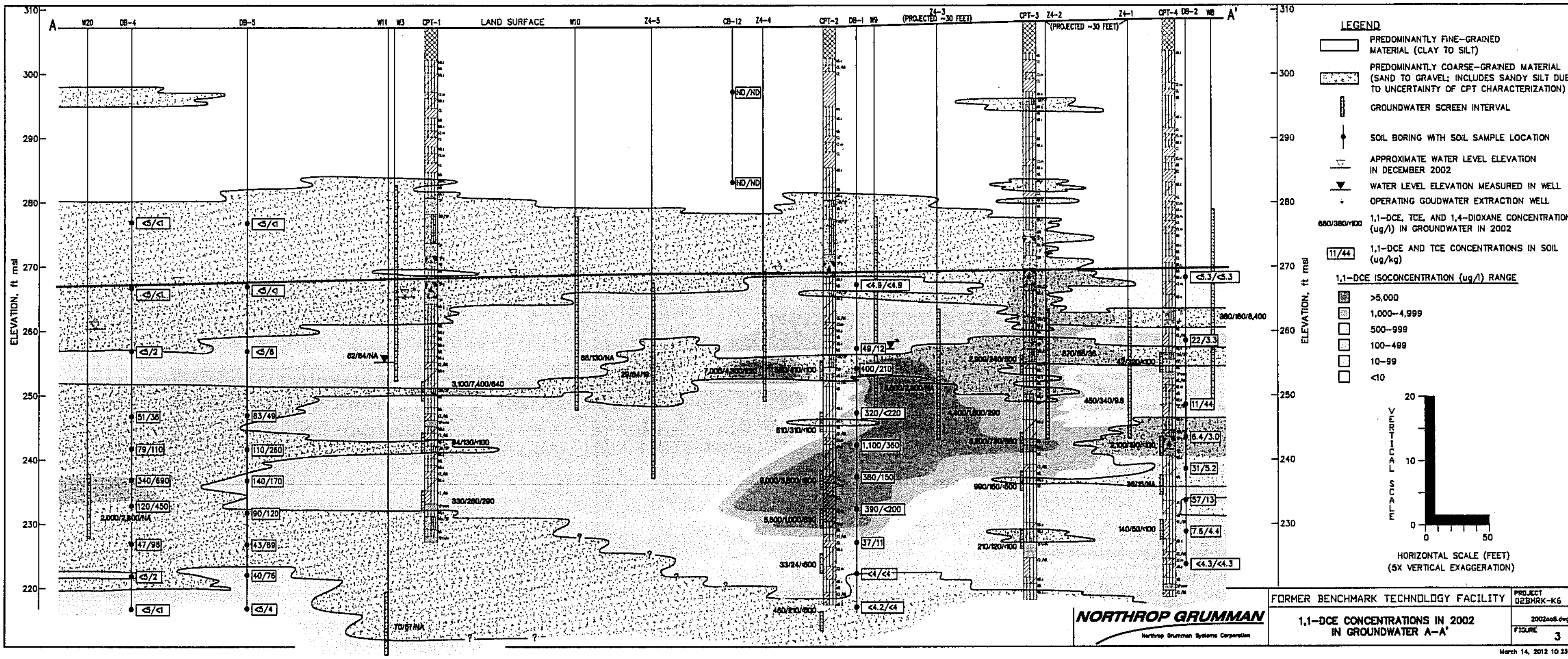
SITE LOCATION MAP

PROJECT (K)	DRAWN BY S/1640	CHECKED BY MT
ART NO 9602146	FIGURE 1	

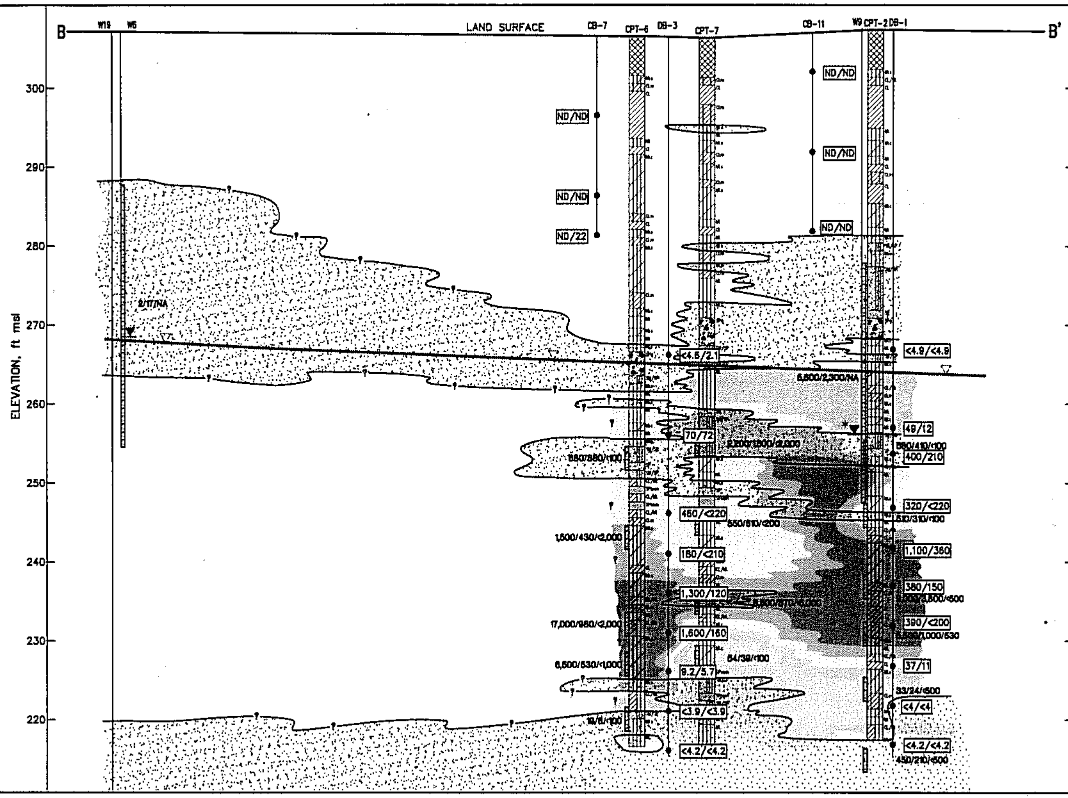


NORTHROP GRUMMAN Northrop Grumman Systems Corporation	FORMER TRW BENCHMARK SITE SITE PLAN	PROJECT 02BMRK-K6 siteplan15.dwg FIGURE 2

March 12, 2012 6:35 pm



March 14, 2012 10:23 pm



LEGEND

PREDOMINANTLY FINE-GRAINED MATERIAL (CLAY TO SILT)

PREDOMINANTLY COARSE-GRAINED MATERIAL (SAND TO GRAVEL; INCLUDES SANDY SILT DUE TO UNCERTAINTY OF CPT CHARACTERIZATION)

GROUNDWATER SCREEN INTERVAL

SOIL BORING WITH SOIL SAMPLE LOCATION

APPROXIMATE WATER LEVEL ELEVATION IN DECEMBER 2002

WATER LEVEL ELEVATION MEASURED IN WELL

* OPERATING GOUDWATER EXTRACTION WELL

680/380/<100 1,1-DCE, TCE, AND 1,4-DIOXANE CONCENTRATIONS (ug/l) IN GROUNDWATER IN 2002

49/12 1,1-DCE AND TCE CONCENTRATIONS IN SOIL (ug/kg)

1,1-DCE ISOCONCENTRATION (ug/l) RANGE

- >5,000
- 1,000-4,999
- 500-999
- 100-499
- 10-99
- <10

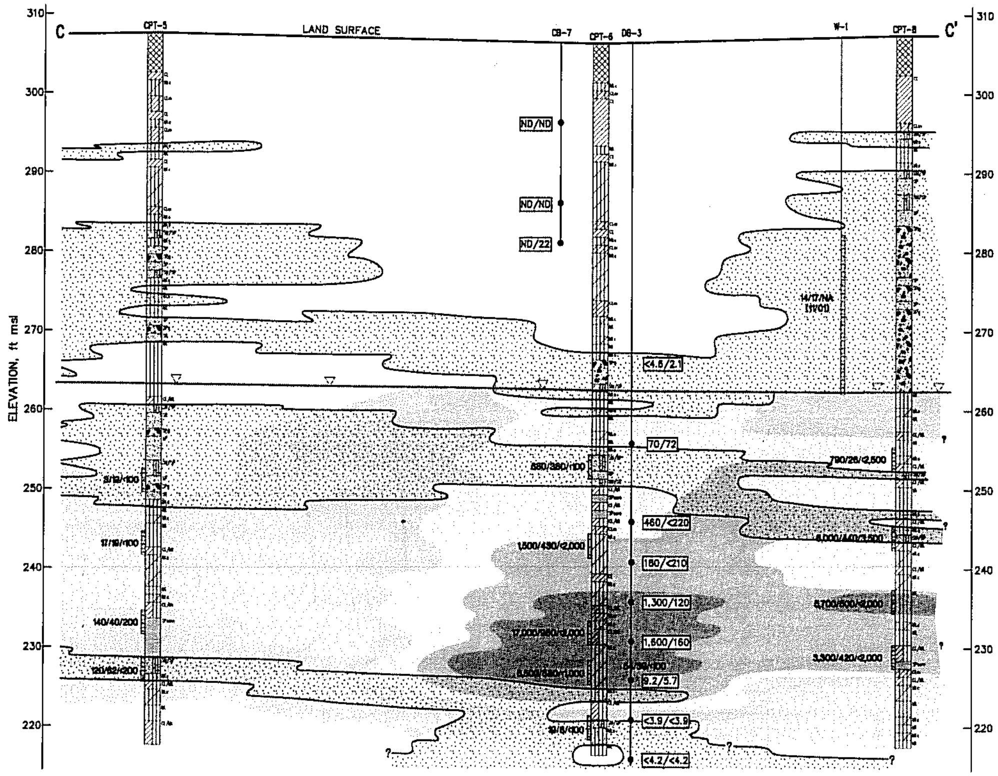
VERTICAL SCALE: 0, 10, 20

HORIZONTAL SCALE (FEET): 0, 50

(5X VERTICAL EXAGGERATION)

NORTHROP GRUMMAN Northrop Grumman Systems Corporation	FORMER BENCHMARK TECHNOLOGY FACILITY	PROJECT TASK B6
	1,1-DCE CONCENTRATIONS IN 2002 IN GROUNDWATER B-B'	2002bb8.dwg FIGURE 4

March 14, 2012 10:48 pm



LEGEND

PREDOMINANTLY FINE-GRAINED MATERIAL (CLAY TO SILT)

PREDOMINANTLY COARSE-GRAINED MATERIAL (SAND TO GRAVEL; INCLUDES SANDY SILT DUE TO UNCERTAINTY OF CPT CHARACTERIZATION)

GROUNDWATER SCREEN INTERVAL

SOIL BORING WITH SOIL SAMPLE LOCATION

APPROXIMATE WATER LEVEL ELEVATION IN DECEMBER 2002

880/380/<100 1,1-DCE, TCE, AND 1,4-DIOXANE CONCENTRATIONS (ug/l) IN GROUNDWATER IN 2002

49/12 1,1-DCE AND TCE CONCENTRATIONS IN SOIL (ug/kg)

1,1-DCE ISOCONCENTRATION (ug/l) RANGE

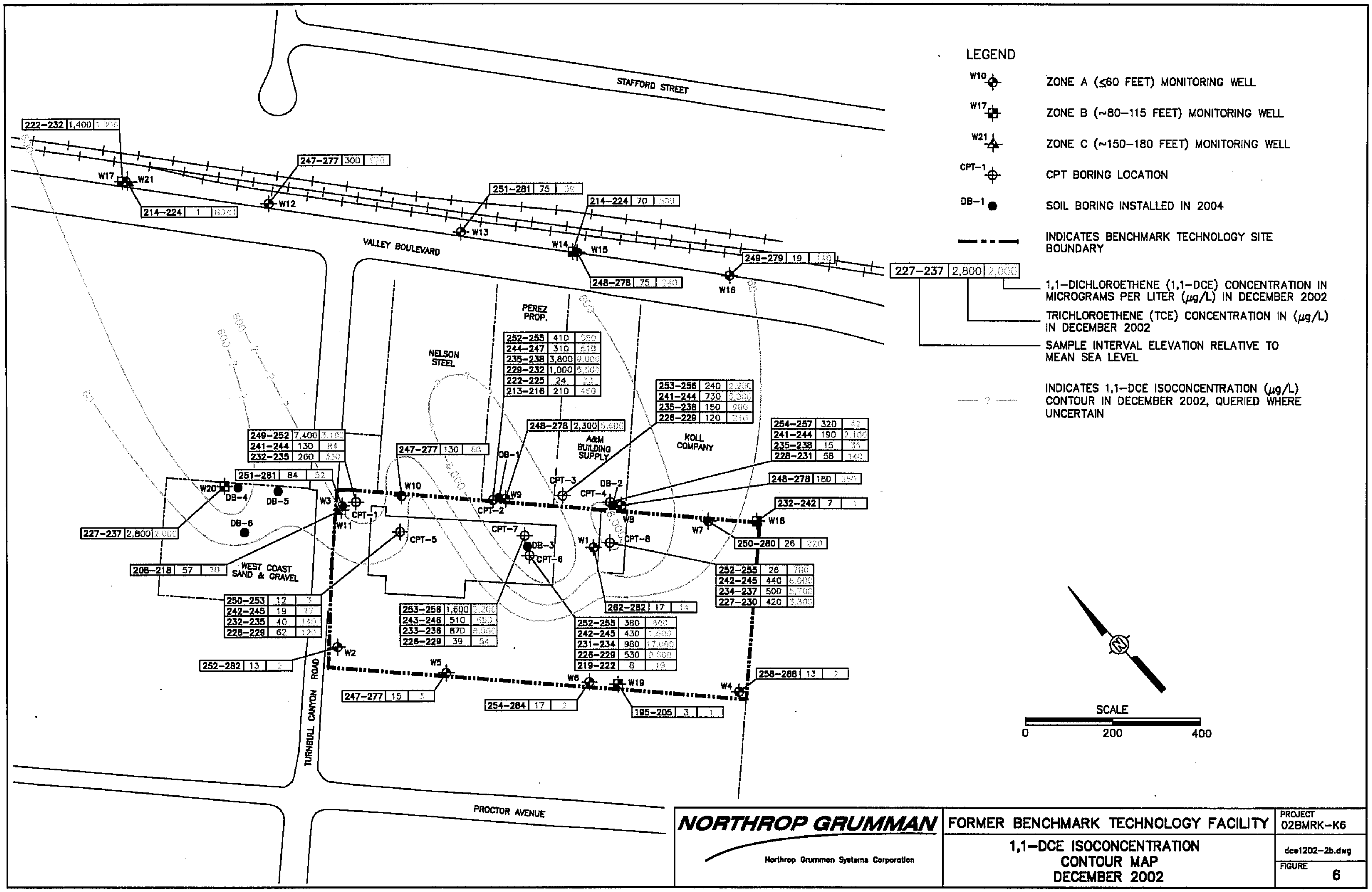
- >5,000
- 1,000-4,999
- 500-999
- 100-499
- 10-99
- <10

VERTICAL SCALE

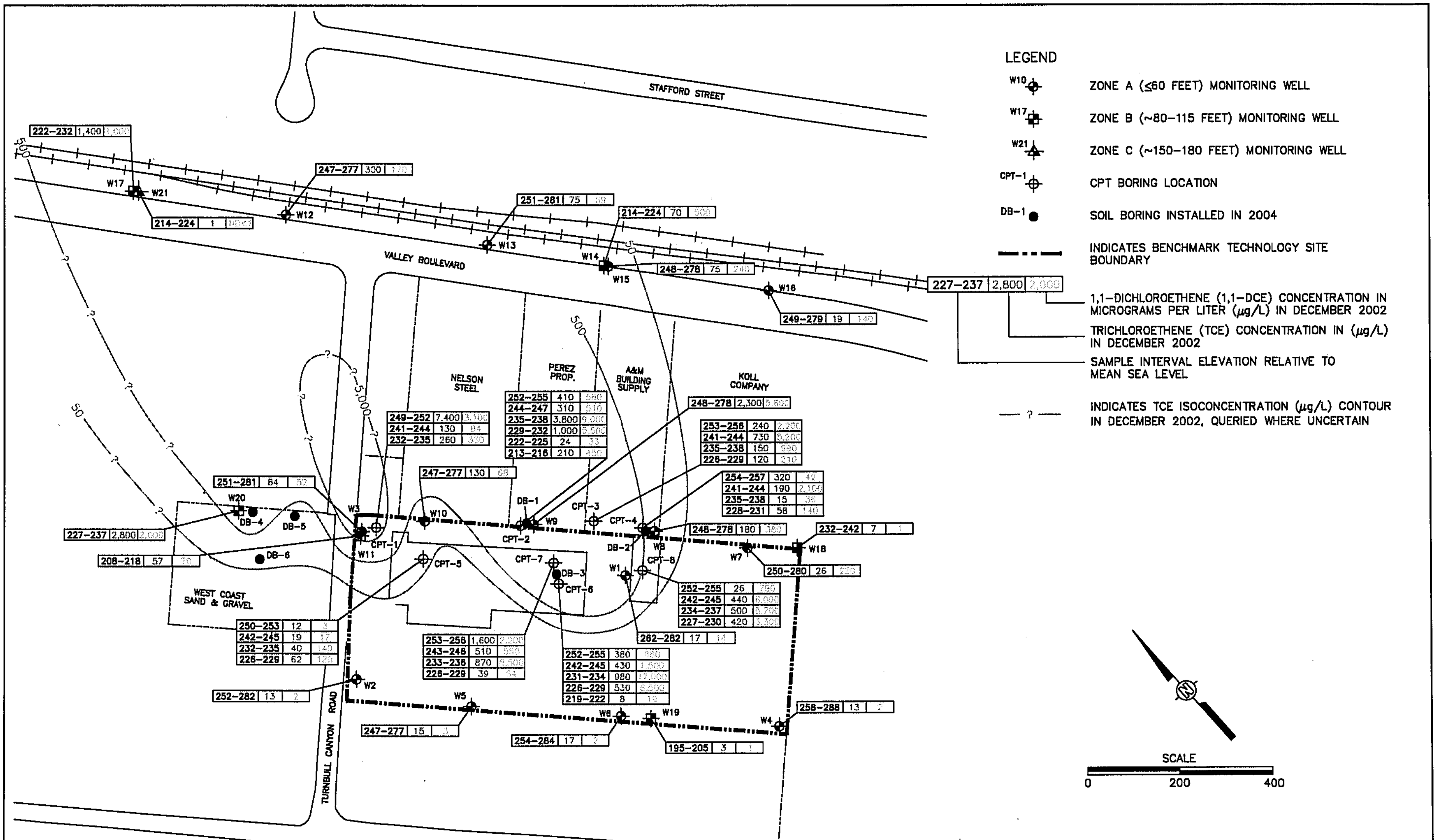
HORIZONTAL SCALE (FEET)
(5X VERTICAL EXAGGERATION)

NORTHROP GRUMMAN	FORMER BENCHMARK TECHNOLOGY FACILITY	PROJECT TASK B6
Northrop Grumman Systems Corporation	1,1-DCE CONCENTRATIONS IN 2002 IN GROUNDWATER C-C'	abc-5b.dwg FIGURE 5

March 14, 2012 11:17 pm



March 13, 2012 4:59 am



NORTHROP GRUMMAN

Northrop Grumman Systems Corporation

FORMER BENCHMARK TECHNOLOGY FACILITY

TCE ISOCONCENTRATION CONTOUR MAP DECEMBER 2002

PROJECT 02BMRK-K6

tce1202-2b.dwg

FIGURE 7

March 13, 2012 4:59 am

Memorandum

To: *Joseph P. Kwan, Northrop Grumman*

From: *Dave Chamberlin, CDM Smith*
Karen Kelley, CDM Smith
Michele Zych, CDM Smith
Brendan Harley, CDM Smith
Bob Fitzgerald, CDM Smith

Date: *March 15, 2012*

Subject: *Summary of CDM Smith Modeling Work in the PVOU, including in the Vicinity of the Former Benchmark Site*

CDM Smith understands that USEPA has requested a description of any and all modeling efforts associated with the former Benchmark facility, including when CDM Smith was provided with the DSI-related onsite CPT data, and if/how such data were incorporated into our groundwater model. The requested information is provided in the text below.

Summary of CDM Smith Modeling in the PVOU

Detailed numerical groundwater flow and transport modeling focusing on the Benchmark source area or immediate offsite area south of Puente Creek has not been performed by CDM Smith to date. The only numerical model that incorporates Benchmark site data is the regional groundwater model (CDM Smith model) constructed in support of the PVOU Intermediate Zone (IZ) Remedy. This regional groundwater model was applied to provide guidance to Northrop Grumman on the drilling of a network of IZ monitoring wells used to delineate the lateral and vertical extent of contamination in PVOU. Later, it was used to locate extraction wells for the IZ Remedy and provide associated remedy design support, support with the establishment of regional performance criteria, support for negotiations with San Gabriel Valley Water Company regarding the planned locations and pumping rates of their B7 well field production wells, etc.

Among other applications of the CDM Smith model performed at Northrop Grumman's request, the regional model was also used in the 2003/04 time period to estimate the range of groundwater levels expected in the Valley Boulevard vicinity, accounting for climate variation, regional water supply pumping, and estimated regional and site remedial pumping. The model was also used to estimate the benefit of potential Benchmark site remedial pumping at Valley Boulevard, assuming "adequate capture" of site contamination, on the regional shallow zone and IZ Remedy. This work was done to assist Northrop Grumman in its negotiations with RWQCB and

USEPA for an expanded groundwater remediation effort for the plume coming from Northrop Grumman's Benchmark facility. The numerical piezometric modeling was conducted concurrent with analytical modeling (e.g., Theis-type analyses) performed by Orion Environmental.

The need for additional, focused modeling work south of Puente Creek incorporating detailed hydrostratigraphy in the Shallow Zone (SZ) has been discussed with Northrop Grumman and USEPA but has not yet been initiated. Further refinements to the model are anticipated to occur once the additional data are collected for the Puente Creek South remedy.

Additional Background – Development of the Regional IZ Model

CDM Smith performed regional groundwater flow and transport modeling from the mid- to late-1990s for the Puente Valley Steering Committee, and later for TRW (now Northrop Grumman Corporation) in support of PVOU IZ Remedy as described in more detail in the March 14, 2008 Groundwater Modeling Report for the IZ Remedy, Appendix C of the Compliance/General Monitoring Plan for the IZ Remedy (CDM 2008). In the 2003-2004 timeframe, CDM Smith was essentially working in parallel with USEPA's consultant who was working on the development of a numerical groundwater model using the FEFLOW model code in support of the design of the SZ Remedy. During this period, CDM Smith and USEPA's consultant exchanged groundwater flow model files on several occasions, held technical meetings to discuss modeling efforts, and were working together to ensure consistency between the USEPA model and the CDM Smith model representations of the aquifers in the PVOU. At that time, CDM Smith essentially adopted the hydrostratigraphic representation for the top four levels of the CDM Smith model from USEPA's contractor. The bulk of the basic groundwater model development by CDM Smith was completed by the end of the 2003-2004 time period.

Transport modeling was performed to simulate the development of regional VOC (PCE, TCE, 1,1-DCE, and 1,4-Dioxane) plumes in PVOU groundwater from multiple known or suspected source areas of these contaminants throughout the OU. The principal objectives of transport model development were:

1. To help delineate the lateral and vertical extent of contamination within PVOU,

2. To simulate contaminant transport in response to hydraulic stresses on the aquifer caused by variations in production well pumping (important for the IZ) and major basin-wide variations in water levels, and

3. To simulate contaminant migration from a variety of known and suspected source areas within the historical flow field such that the simulated VOC plumes reasonably matched observed water quality data in the network of regional groundwater monitoring wells and reasonably matched VOC mass removed at the production wells in the B7 well field.

Between 2005-2007, the extraction wells for the SZ Remedy and IZ Remedy were installed by the work parties, and additional data became available as a result of the drilling, well installation, and aquifer performance tests performed as part of these efforts. The CDM Smith model was updated to incorporate this information and the period of the transient simulation was extended from October 2003 to October 2006. Specifically, the layer thickness of some model layers was adjusted and hydraulic conductivity values were modified in the layers representing what is now called the Upper Intermediate Zone (MZ) and the Lower Intermediate Zone (IZ). The model was documented in the Groundwater Modeling Report (CDM Smith 2008) at this point in its development.

In late 2010 or early 2011, the period of the transient simulation was extended to October 2009 in response to a request from USEPA.

Numerical Model Applications

CDM Smith has used the numerical groundwater flow and contaminant transport components of the model in numerous applications for Northrop Grumman. The principal purpose of the model was to assist in the design of the IZ Remedy extraction system, namely to identify appropriate extraction well locations and depths to meet the objectives of the Interim Record of Decision (ROD) and Explanation of Significant Differences (ESD). The model is also to be used as a tool to help evaluate compliance. The model has also been used in numerous applications to help understand and interpret field data. In other examples, the model was used to evaluate proposed modifications of pumping at the San Gabriel Valley Water Company B7 well field, and to estimate the range of water levels expected at Valley Boulevard and the potential benefits to the regional remedy of remedial pumping at Valley Boulevard as noted above.

Simulation of a Source at the Former Benchmark Facility

As documented in the Groundwater Modeling Report (CDM 2008), a source area was simulated, as one of many known or suspected source areas within the PVOU, at the former Benchmark facility in CDM Smith's PVOU regional model. Regional model source terms (or loading rates) were assigned to represent the rate of down-gradient transport of contamination from the source area. The best indicator of transport from a source area is measured concentrations in down-gradient wells. Measured source area concentrations are often not indicative of down-gradient transport potential because the concentrations may be measured in relatively impermeable soils or soil zones that are relatively isolated from the main pathways of groundwater flow. During calibration, regional model source terms were, therefore, adjusted for the various source areas represented in the model, including Benchmark, until a reasonable match was achieved between the simulated and observed water quality in the groundwater monitoring well network near the simulated source areas, and until the resultant plumes of contamination reasonably matched the lateral and vertical extent of contamination observed in the regional network of monitoring wells.

The source area at Benchmark was simulated as a simple line source at the water table, constant for the entire simulation. This representation of the contaminant source at the former Benchmark facility is general in nature, and is appropriate for regional-scale modeling. CDM Smith was provided with the Benchmark DSI CPT data in 2004. These data were reviewed to (a) identify any inconsistencies with the stratigraphy represented in the PVOU model, and (b) assess whether the soil chemistry data were relatively consistent with the source term estimated by approach described above. As noted above, CDM Smith's PVOU modeling has always assumed that the Benchmark facility is a continuing source of contaminants to groundwater, owing to the technical infeasibility of removing all mass from the fine-grained portions of both the unsaturated and saturated zones on the property. No inconsistencies with the stratigraphy or the represented source terms were identified; as a result, no modifications were made to the regional model in light of these CPT data.

Three-dimensional Representation of the Benchmark Plume and 2-D Animations of Plume Migration

Beginning in December 2010 and in preparation for the February 10, 2011 meeting with USEPA, CDM Smith imported stratigraphic layers as represented in the IZ regional groundwater model into a data visualization tool and generated 3-D graphical presentations to present to USEPA. This was not numerical modeling but an interactive data display. These graphics, which can be manipulated by the viewer for inspection in three dimensions, were generated using EVS/MVS data software package (http://www.ctech.com/) and illustrated water quality data in the network of Benchmark site wells and regional network of PVOU extraction wells and monitoring wells. The graphics also incorporated output from the regional CDM Smith numerical transport model.

Additional two-dimensional animations were shown at the meeting. These showed the development of plume contours from the regional model source area at the former Benchmark facility and the movement of the simulated contaminant plume in response to regional aquifer stresses over time. These animations were visual depictions of simulation results from the CDM Smith model. These graphics were presented to USEPA at the February 2011 meeting. Copies of the graphics were not requested by USEPA, CH2MHILL, or DTSC at the meeting. These graphics are available to USEPA, upon request and can be viewed using a free downloadable viewer.